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Summary

The church of St Peter, Barton on Humber, is renowned for the surviving Saxon masonry tower and baptistry at the west end of a later nave and chancel. The church fabric and archaeology have been the subject of an extensive study directed by Warwick Rodwell which is now approaching publication. A tree-ring sampling programme of structural timbers throughout the building and a number of non-structural objects, including two chests in the adjacent church of St Mary that were originally from St Peter, was commissioned to help inform the publication.

The tree-ring analysis indicates that the proposed development sequence of the church is compatible with the dates of the timbers, at least for those phases with suitable surviving timbers. Unfortunately many phases of the church, and in particular the earliest material associated with the tower and baptistry, contain timbers unsuitable for dendrochronological dating because to few rings are present in the surviving timbers.

Keywords

Dendrochronology
Standing Building

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Introduction

This document is a technical archive report on the tree-ring analysis of timbers from the church of St Peter, Barton on Humber (Figs 1 and 2; NGR TA 0347 2194), located on the northern edge of the historic county of Lincolnshire, formerly part of Humberside and now within the unitary authority of North Lincolnshire. It is beyond the dendrochronological brief to describe the building in detail or to undertake the production of detailed drawings. Elements of this report may be combined with detailed descriptions, drawings, and other technical reports to form the comprehensive publication planned for the site.

The church of St Peter, Barton on Humber, is renowned for the surviving Saxon masonry tower and baptistry at the west end of a later nave and chancel. An extensive series of modifications to the fabric have been outlined by Warwick Rodwell through excavation and fabric analysis (Fig 3). A tree-ring dating programme of the extant structural timbers of the church, as well as a number of non-structural objects was requested by Keith Miller, English Heritage Inspector of Ancient Monuments, to help inform the final stages of the publication programme.

Methodology

The general methodology and working practises used at the Sheffield Dendrochronology Laboratory are described in English Heritage (1998). The methodology used for this building was as follows.

The sampling reported here was undertaken on a number of occasions using a variety of techniques. A survey of all the church timbers in company with Warwick Rodwell identified those areas where timbers appeared to contain potentially suitable material. Those with more than 50 annual rings and some survival of the original sapwood and bark-edge were sought, although with the 'Saxon' timbers buried in the tower and baptistry walls any assessment of suitability was impossible. The dendrochronological sampling programme attempted to obtain cores or other samples from as broad a range of structural timbers, in terms of structural element types, scantling sizes, and carpentry features, as was possible within the terms of the request, the Scheduled Monument Consent documentation, and with due regard to safety on site.

The most promising structural timbers were sampled using a 15mm diameter corer attached to an electric drill. The cores were taken as closely as possible along the radius of the timbers so that the maximum number of rings could be obtained for subsequent analysis. The resulting core holes were photographed (see Appendix 1) and then filled and stained. The ring sequences in these cores were revealed by sanding. The lengths of removed timbers from the ringing chamber floor were assessed for suitability and the best material was sampled by removing cross-sections, or segments of cross-sections, by hand saw. The ring sequences in these slices were revealed by sanding. The tree-ring series from the non-structural items identified in the assessment as suitable for analysis were recovered in a variety of ways; some of the decorated chancel screen timbers, and the two chests (both chests are in St Marys, the former chapel of St Peters but now the parish church, but both originally derive from St Peters, Rodwell pers comm) were recovered by photographic record, planks in the north aisle door, and other parts of the decorated chancel screen timbers were recovered by *FIMO* moulding (Leuschner and Leuschner 1996).

The complete sequences of growth rings in the cores and slices, and on the moulds and photographs that were selected for dating purposes were measured to an accuracy of 0.01mm using a micro-computer based travelling stage (Tyers 1999a). The series recovered from the photographs were uniformly divided to yield series with the equivalent measurement scale. The ring sequences were plotted onto semi-log graph paper to enable visual comparisons to be made between sequences. In addition a cross-correlation algorithm (Baillie and Pilcher 1973) was employed to search for positions where the ring sequences were highly correlated. These positions were checked visually using the graphs and, where these were satisfactory, new mean sequences were constructed from the synchronised sequences. The *t*-values reported below are derived from the original CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position must be obtained from a range of independent sequences, and that these positions are supported by satisfactory visual matching.

All the measured sequences from this assemblage were compared with each other and any found to cross-match were combined to form a series of interim site master curves. These, and any remaining unmatched ring sequences were tested against a range of reference chronologies, using the same matching criteria: high *t*-values, replicated values against a range of chronologies at the same position, and satisfactory visual matching. Where such positions are found these provide calendar dates for the ring-sequence.

The tree-ring dates produced by this process initially only date the rings present in the timber. The interpretation of these dates relies upon the nature of the final rings in the sequence. If the sample ends in the heartwood of the original tree, a *terminus post quem (tpq)* for the felling of the tree is indicated by the date of the last ring plus the addition of the minimum expected number of sapwood rings which are missing. This *tpq* may be many decades prior to the real felling date. Where some of the outer sapwood or the heartwood/sapwood boundary survives on the sample, a felling date range can be calculated using the maximum and minimum number of sapwood rings likely to have been present. The sapwood estimates applied throughout this report are a minimum of 10 and maximum of 46 annual rings, where these figures indicate the 95% confidence limits of the range (Tyers 1998a). These figures are applicable to oaks from England and Wales. Alternatively, if bark-edge survives, then a felling date can be directly utilised from the date of the last surviving ring. The dates obtained by the technique do not by themselves necessarily indicate the date of the structure from which they are derived. It is necessary to incorporate other specialist evidence concerning the re-use of timbers and the repairs of structures before the dendrochronological dates given here can be reliably interpreted as reflecting the construction date of phases within the structure.

A further important element of the tree-ring analysis of buildings and archaeological assemblages is the identification of 'same tree' groups within the sampled material. Inspection of timbers, both in buildings and archaeological sites, often suggests that the patterns of knots or branching in timbers are so similar that they appear to be derived from a single tree. Tree-ring analysis is often used to support these

suggestions. The identification of 'same tree' groups is based on a combination of high levels of matching between samples, extremely similar longer term growth trends, and individual anatomical anomalies within the timbers. High *t*-values are not by themselves necessarily indicative of two series being derived from a single tree. Conversely low *t*-values do not necessarily exclude the possibility. It is the balance of a range of information that provides the evidence.

Results

Forty nine timbers were sampled by either coring (30), taking *FIMO* moulds (5), cutting slices (5), or taking photographic mosaics (9) during the period January - April AD 2001. Thirty three of these proved suitable for measurement, and 13 of these have been dated. The results are discussed for each area of sampling, approximately arranged in their predicted date order.

Saxon tower and baptistry

The tenth-century stone tower includes four timber plates within the stonework, these are presumed to be part of the original construction. The top of the baptistry retains some complete and some stub-ends of horizontal beams also thought to be part of this phase. Access to these timbers was by ladder for the tower plates, and an *ad hoc* arrangement of scaffold boarding laid over the various joists at the top of the baptistry gave access to the joists that could not be reached from the normal access ladders. Three of the tower plates and three of the baptistry joists were selected for sampling (Table 1; Figs 4 and 5). In the case of the tower plates the minimal visual cues provided by the exposed face meant that optimal sampling directions were not always achieved. In the event during sampling it became clear that in each case only the outer few centimetres of these plates survived, and that there were voids and/or later masonry behind them. Two plates were cored more than once at different locations to ensure this was not an isolated problem. The joist ends could be more reliably assessed and the sampling directions more readily achieved. There was no survival of sapwood in this area, which is not especially surprising given the presumed age of the material, curving surfaces thought to be equivalent to the original heartwood/sapwood boundary were present on most. The samples were numbered **5**, **6**, **8-10** inclusive, and **14**. One of the samples (number **14**) when examined in the laboratory was rejected due to it having too few rings for reliable analysis. In total therefore five samples were measured from this area and the resultant series were then compared with each other. All were short sequences and several of the cores produced series shorter than would normally be considered acceptable. Perhaps inevitably given the available material, but to great disappointment, none were found that matched together to form internally consistent groups.

Ringing chamber floor

The ringing chamber floor, thought to be Norman, had been demolished in the AD 1970s but the timbers were retained in a heap in the south aisle. Some retained their numbers from the building recording programme, but most did not. The cut edges of these were assessed for their potential to supply usable tree-ring samples, and the best four oak timbers, and one of the pine timbers were cut at the most appropriate point for this purpose (Table 1). Many of the smaller timbers in the heap were unsuitable for

analysis as they retained too few rings, but the larger cross-members were both thought less likely to be later replacements and more likely to be usable for dating purposes. The single sampled pine timber is almost certainly later but was sampled for comparison with the pine chest (discussed below). The samples were numbered **28-32** inclusive. The pine sample (number **32**) when examined in the laboratory was unfortunately rejected due to it having degraded too badly for the rings to be reliably resolved. In total therefore four samples were measured from this area and the resultant series were then compared with each other. Samples **28** and **29** were found to match well (t = 11.49) indicating they are derived from a single highly aberrant tree (Fig 6). A 134-year interim mean sequence was calculated from these, named BOHSP2829. The other two oak samples **(30** and **31)** both have below the normally accepted minimum sequence length, and although they match each other (t = 4.40) the combined sequence is only 40-years long, and thus too short to be of any analytical use.

Timber spire base frame

There are two structures superimposed on one another at the top of the Norman tower extension. The grid of large horizontal beams at the top of the tower is the base of an earlier timber spire (Fig 7), above it is a low pitched roof that replaced the spire. The phasing of this area is complex. There are clearly re-used timbers in the upper structure, and the roof both uses and probably amended the base frame. Timbers throughout the structures were assessed and items that contained usable sequences and that could be safely reached (the steel bell-frame makes ladder arrangements awkward in this area) were cored. Eight cores were obtained in this area, but only two are definitely part of the earlier base frame (Table 1). The other samples from this area are discussed below. These samples were numbered **21** and **22**. There was limited survival of sapwood on these elements. Both samples were measured and the resultant series were then compared with each other. The sequences were found to match (t = 5.09). A 64-year interim site mean chronology was calculated, named BOHSP_BF.

North aisle base plate and central beams

Most of the north aisle consists of softwood timbers, these are probably of nineteenth-century origin (Rodwell pers comm). However three oak timbers are re-used within the structure, two decorated east-west beams down the centre of the aisle (that could be described perhaps as purlins?), and a moulded wall plate on the south wall at the eastern end. All these timbers were assessed, and the two suitable timbers cored from a scaffold tower (Table 1; Fig 8). The decorative mouldings have led to the limited survival of sapwood on these timbers. The samples were numbered **36** and **37**. Both of these samples when examined in the laboratory were rejected due to them having relatively few rings and having badly fragmented during sampling. No samples were measured from this area. Note that the north porch roof timbers were also examined but these contain too few rings for sampling to be considered.

North door

The north porch door consists of two layers of oak planking, one horizontal, and one vertical, riveted together with diamond-headed rivets, and suspended with decorative ironwork hinges. At some later stage an ogee-headed wicket gate has been cut through the door. The end grain of the horizontal elements is

thus visible on the hinge end of the wicket gate on a surface that is not original to the door (Fig 9). Discussions at the site with Keith Miller and Warwick Rodwell supported the suggestion that interventions necessary to date the door on this non-original surface would be appropriate. There are six plank ends here with reasonably vertical edges. Access to the two lowest is made difficult by both the wicket gate hinge and the bottom rail of the door, but the next four plank ends were each felt capable of cleaning and sequence recovery via the *FIMO* moulding method of Leuschner and Leuschner (1996). This method has been successfully employed on a number of plank objects in England in recent years eg (Tyers 1999b; 1999c; Groves 2000a; 2000b). A series of moulds from these four timbers were made the samples were numbered **26-27** inclusive, and **37-38** inclusive (Table 1). All four sequences were measured and the resultant series were then compared with each other. No matching was identified between the sequences.

South aisle

The south aisle, like the north aisle, the nave, and the chancel has a later softwood roof. As with the north aisle a few decorated oak beams have been reused within the framework. This presumably indicates that the timber layout of the replacement roof is similar to the original layout otherwise the oak timbers wouldn't fit. Along the north wall of the aisle are a series of timber corbels, vertical posts, and other miscellaneous timbers. The east wall also has some remnant timbers. Each timber was assessed; the central east-west beams in the roof, and the wall plate surviving in the western bay of the north wall all from a scaffold tower, whilst the corbels and other timbers were viewed by long ladder. Timbers which appeared suitable were sampled by coring. In total six timbers were selected, three corbels, the moulded wall plate, and two moulded central beams from the roof (Table 1; Fig 8). As before there was limited survival of sapwood throughout these timbers. These samples were numbered **11-13** inclusive, and **33-35** inclusive. Two of the samples (numbers **11** and **34**) when examined in the laboratory were rejected due to them having too few rings for reliable analysis. In total therefore four samples were measured from this area and the resultant series were then compared with each other. No sequences were found that matched together to form internally consistent groups.

South porch

The south porch has a simple oak roof but appears to include one earlier timber in the southern wall plate (Fig 8). The most suitable material identified by assessment is the southern wall plate and two timbers from the west side of the roof. These three timbers were sampled by coring (Table 1). Sapwood survived on the two roof timbers. The samples were numbered **15-17** inclusive. All three samples were measured and the resultant series were then compared with each other. None were found that matched together to form internally consistent groups.

Chancel screen

The chancel screen consists of a particularly fine series of horizontal highly decorative carved oak panels inset into the plainer structural elements (Fig 10). The vertical boarding on the lower section of the screen appears to be later replacement, perhaps following iconoclastic destruction. The grain of the carved

planking is visible within the spandrels. The sequences from a selection of these were obtained by a combination of *FIMO* moulds and photography. One set of interventions were made on a panel released from a one of the screen doors, and subsequently returned to it. The rest were derived *in situ* from the screen panels (Table 1) the samples were numbered **7**, and **40-45** inclusive. The six photographic series (numbers **40** to **45** each one a mosaic of overlapping close-up pictures made without making any intervention into the original surfaces of the carved panels) were, after film processing, found to have too few well resolved rings for reliable analysis. In total therefore one sample was measured from thus structure.

Tower roof

As discussed above there are two structures superimposed on one another at the top of the tower extension. The grid of large horizontal beams at the top of the tower appear to be the surviving part of an earlier timber spire, whilst above it is a low pitched roof that replaced the spire, there is also a central cruciform structure assumed to be later (Fig 7). The phasing of this area is complex, since there are clearly re-used timbers in the upper structure, and the roof appears to both use and probably to have amended the base frame. Although two of them are not certainly part of this structure all six samples that were taken in this area that are not discussed above are treated as part of this phase (Table 1). The samples were numbered **18-20** inclusive, and **23-25** inclusive. All of the samples when examined in the laboratory were found to have sufficient rings for analysis and all six were measured. The resultant series were then compared with each other, four of these sequences were found that matched together to form one internally consistent group (Table 2). A 108-year interim site mean chronology was calculated, named BOHSP_TR. Sapwood survival is particularly good in this part of the structure, sample **19** retains bark-edge and is the only such sample from the church.

Chancel roof

The chancel roof structure is mostly concealed behind modern softwood boarding and is probably mostly a modern replacement. There are however four exceptionally long oak tiebeams (*c* 8.5m length) crossing the chancel at ceiling level (Fig 8). These have simple chamfer stops and redundant sockets for bracing, or similar features, now lost. All four tiebeams were sampled, and it was discovered during this that they are laid alternately top end and bottom end presumably so as to even out the slight taper and differences in strength of these long slender timbers (Table 1). The samples were numbered **1-4** inclusive. All of the samples when examined in the laboratory were found to have sufficient rings for analysis and all were measured. The resultant series were then compared with each other. All of these sequences were found to match together to form one internally consistent group (Table 3). An 80-year interim site mean chronology was calculated, named BOHSP_CR. Sapwood survival was good in this part of the structure, although the depredations of death-watch beetle at some stage (no longer active) made it prone to disintegrating whilst coring.

Corbel

An oak corbel with a carving of head, originally from Barton, but now stored at Helmsley was examined with a view to assessing its suitability for dendrochronology. This timber was clearly once tenoned into something, but the tenon has been cut off exposing the rings reasonably clearly. The corbel was moved to the laboratory where the ring sequence was examined under a microscope. The timber has a quite distorted ring sequence, suggesting there was a knot not very far away in the tree. The sequence has a non-resolvable band of narrow rings in the middle of the surviving sequence and was not measured or analysed (Table 1).

Pine chest

This is one of two chests now in St Mary's but previously in St Peter's. This chest is constructed from a series of softwood boards, presumed to be pine although not positively identified as such. The chest is normally locked but Canon Hepworth kindly arranged for it to be unlocked for assessment and for subsequent attempts at analysis. The boards are too narrow for coring, because softwoods require different coring tools to hardwoods, and no softwood corer is narrow enough undertake this operation. Moulding using *FIMO* has not been successfully managed on dry softwood boards (Groves pers comm) and wasn't attempted here, direct measurement was not practicable due to difficulties of access with equipment, which left photography as the only other alternative. The lid has been cut to form two independent lid sections at some stage and the edges of the boards exposed by this process were photographed without any cleaning being attempted. Two boards were 'sampled' as a mosaic of overlapping close-up pictures (Table 1). After processing the film, examination of the negatives showed that the ability to resolve the ring sequences reliably was limited. Since softwoods often have very narrow rings interspersed amongst the wider rings the inability to resolve the sequences reliably precludes any attempt at analysis of these photographs. The only reliable analysis that could be undertaken would require greater intervention into the board ends than was considered appropriate at this time by the site team.

Dugout chest

This is one of two chests now in St Mary's but previously in St Peter's. This chest is constructed from a single oak log, hollowed out forming the base of the chest, with a single plank forming the lid. The baulks at the end are thick enough to core with standard corers but in the first instance it was felt to be more appropriate to examine the exposed end-grain on the inner faces. The right hand inner face baulk was 'sampled' as a mosaic of overlapping close-up pictures (Table 1). After processing the film, examination of the negatives showed that the ability to resolve the ring sequences reliably was limited. The only reliable analysis that could be undertaken would require greater intervention into the chest than was considered appropriate at this time by the site team. The tree used is fairly fast grown and the chest probably contains less than 75 rings, there may be little chance of dating the chest even if we could obtain the sequence.

Dating the interim site means

The four interim chronologies, and the remaining unmatched samples were then compared with each other. This identified that none of the interim series correlated particularly well with any other, nor did any of the undated series match these or each other. The interim sequences, and the residual undated material, was then compared with dated reference chronologies from throughout the British Isles and northern Europe. Single well correlated positions was identified for three of the interim chronologies and single well correlated positions for three individual plank sequences from the north door and chancel screen were also identified by this method (Fig 11). The short material which it had been hoped could be matched internally was not suitable for individual comparison with dated reference chronologies. No other dating evidence was obtained. These results are discussed in the same order as above.

Timber spire base frame: Table 4 shows the correlation of the BOHSP_BF mean sequence at its identified dating position, AD 1247 – AD 1310 inclusive. This identifies the material as probably local oak. Table 5 lists this site mean chronology. The presence of the heartwood/sapwood boundary on both samples at AD 1307 and AD 1310 provide a combined felling date range for this structure of AD 1320 – 53 inclusive (Fig 11). In all likelihood therefore this is a pre-Black Death phase of aggrandisement to the church.

North door: Table 6 shows the correlation of two of the measured series from the north door planks at their identified dating positions. Tables 7 and 8 list the two series. The matches identify the material as imported oak planking from the eastern Baltic. The absence of sapwood on this material is not unexpected, but the similarity of end-dates (Fig 11) perhaps suggests there was, as is usual, little excess trimming of outermost heartwood rings. A felling date of after AD 1385 is indicated for the trees by dendrochronology. Evidence from the analysis of other groups of Baltic planking suggests that relatively little heartwood was trimmed off such boards. In addition, the time taken to transport the material from its source is thought to be less than a season, and its exceptional straight grained nature would obviate the need to season the material. The differences in workability of oak before and after seasoning would also encourage the use of relatively freshly felled material since this would make the door easier to construct. Combining this evidence suggests that the construction date for the door is most likely either from the end of the fourteenth century or within the first third of the fifteenth century.

Chancel screen: Table 6 also shows the correlation of the measured sequence from the chancel screen at its identified dating position. Table 9 lists the series. This is also therefore an imported oak plank from the eastern Baltic, although the differences in matching the reference series probably indicates it came from a different area than the north door planks. The absence of sapwood on this is not unexpected, a felling date after AD 1458 is indicated for the tree. The same types of evidence employed in the discussion of the door planks indicates this structure may have been originally constructed in the second half of the fifteenth century. It should be noted that carving of this intricacy would be significantly easier to undertake on green timber.

Tower roof: Table 10 shows the correlation of the BOHSP_TR mean sequence at its identified dating position, AD 1606 – AD 1713 inclusive. This identifies the material as probably local oak. Table 11 lists this site mean chronology. The presence of surviving bark-edge on one of the samples with an incomplete ring for AD 1713 indicates felling of this tree occurred in the spring or shortly thereafter of that year. Applying sapwood estimates to the other three samples yields felling date ranges that include this year (Fig 11) and it thus seems probable that all the material is the product of a single phase of construction in or shortly after AD 1713.

Chancel roof: Table 12 shows the correlation of the BOHSP_CR mean sequence at its identified dating position, AD 1680 – AD 1759 inclusive. This identifies the material as probably local oak. Table 13 lists this site mean chronology. The presence of the heartwood/sapwood boundary on all samples, and some surviving though detached sapwood on most of the samples, provides a felling date range for the four samples of AD 1766 – 97 inclusive (Fig 11). In all likelihood this provides a date for the construction of the chancel roof.

Discussion

The results from this analysis are somewhat mixed: the results from the Saxon tower and baptistry timbers are especially disappointing, particularly since the recent analysis of the coffin timbers (Tyers forthcoming) has produced an exceptionally well replicated and undoubtedly local chronology that covers all the likely period of construction for this early part of the church. The failure to obtain any sample from this part of the structure with more than 54 rings in it is probably the end of opportunities for identifying independently the date of the church until scientific dating techniques are further improved. Much of the rest of the material used to build the church was assessed as, and subsequently proved to be, derived from short-lived relatively fast growing trees, resulting in a widespread failure to obtain datable samples. Series of samples were taken from these areas in the hope they would combine to form useable sequences. The later phases of activity in the tower and chancel roofs both yield short but datable series, and the fine quality planking used in the north door and the chancel screen yield long sequences that yet again demonstrate the presence of imported planking in the medieval period in England, clearly derived from a fairly large geographical source area within the eastern Baltic zone. The only datable medieval timbers located were those forming the base frame of the now lost timber spire. These indicate this feature was probably a pre-Black Death phase of construction. One timber forming part of the request, a bell frame joist end removed from the church in the AD 1980s was not located.

Conclusion

Analysis of a series of 49 samples from timbers throughout St Peters has produced datable timbers in five separate elements of the church. These show that the structure was undergoing expansion and modifications between the fourteenth and eighteenth centuries. Much of the material is faster grown and younger than the coffins boards separately analysed (Tyers forthcoming). This may suggest that different elements of the landscape were being exploited for the church structure as compared with the trees that were used to construct the coffins.

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Tyers, I, 1999e *Dendrochronological spot-dates of timbers from the Millennium Foot Bridge sites (MBC98) and (MFB98) London*, ARCUS Rep, **521**

Tyers, I, 1999f *Dendrochronological spot-dates of timbers from the former Charringtons Wharf site (BKW99), Blackwall Way, London, E14*, ARCUS Rep, **529**

Tyers, I, 2000 *Tree-ring analysis of re-used boat timbers excavated at Chapel Lane Staith, Hull*, ARCUS Rep, **570**

Tyers, I, forthcoming *The tree-ring analysis of coffin timbers excavated at the Church of St Peter, Barton on Humber, North Lincolnshire*, Centre for Archaeol Rep

Figure 1 Location of Barton on Humber within England and Wales, based upon Ordnance Survey map

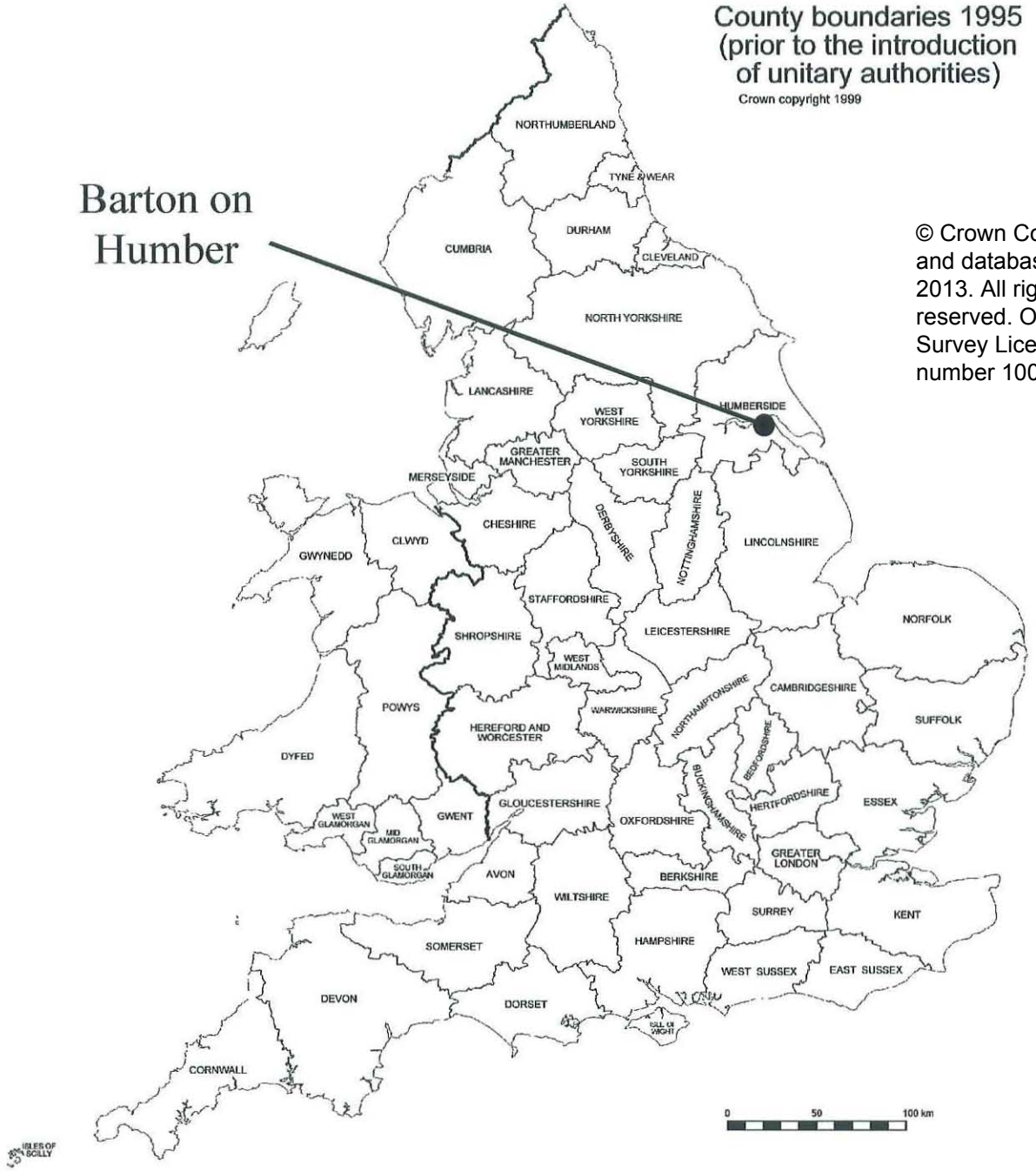


Figure 2 Location of the churches of St Peter and St Mary in Barton on Humber

Figure 3 Summary phase plan of the development of the church (after Rodwell in English Heritage 2000)

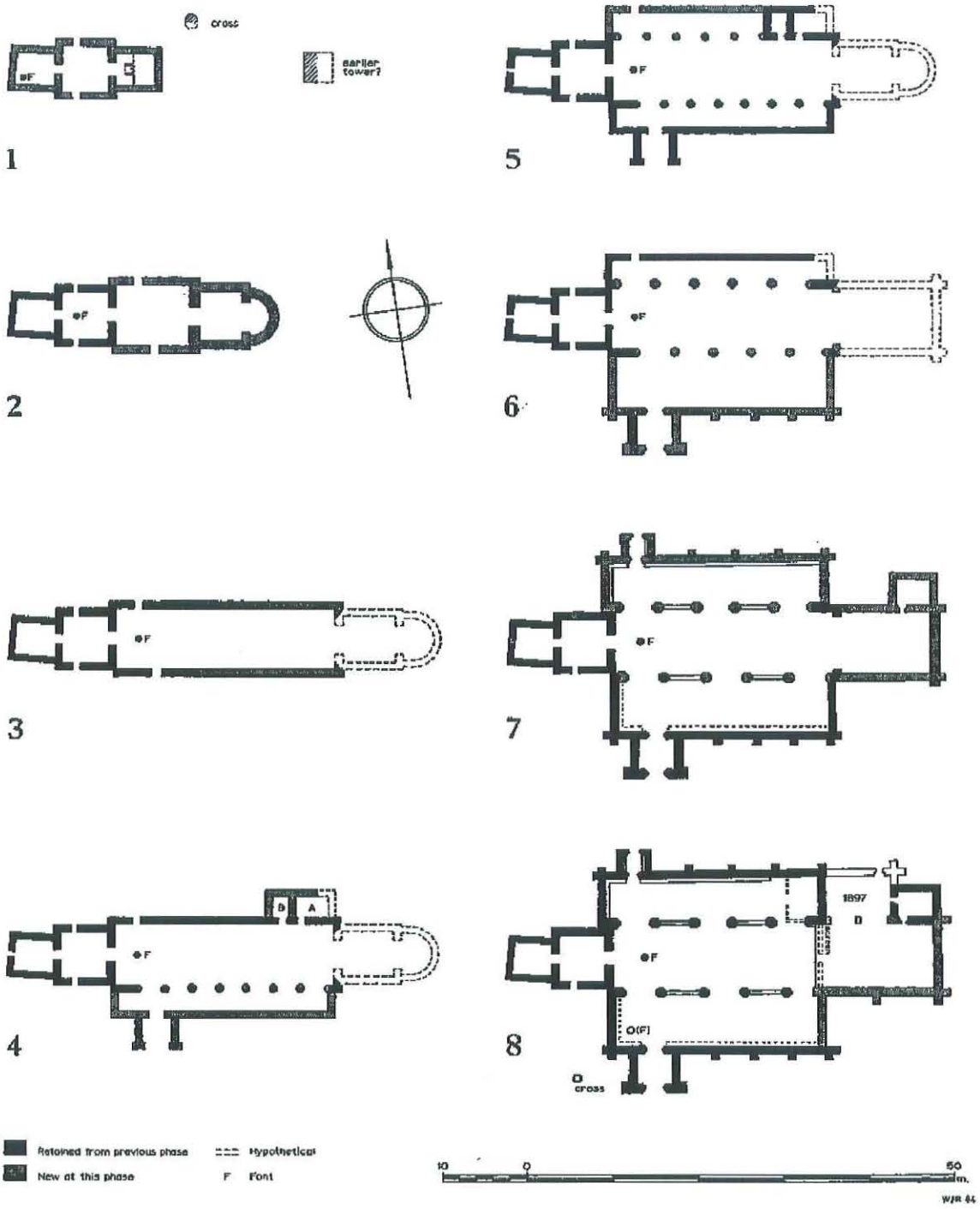


Figure 4 Internal elevation of the north walls of the lower part of the tower and the baptistry (after Atkins and Rodwell pers comm), showing approximate location of samples from this area

Figure 5 Internal elevation of the south walls of the lower part of the tower and baptistry (after Atkins and Rodwell pers comm), showing approximate location of samples from this area

Figure 6 Growth diagram showing the close similarity of the series from samples 28 and 29. The sequence is also somewhat aberrant; for example during the period from 50-95 years the tree is unusually slow growing, whilst the series of wide rings interspersed by narrow rings from ring 100 onwards may indicate this tree was being subjected to some interference

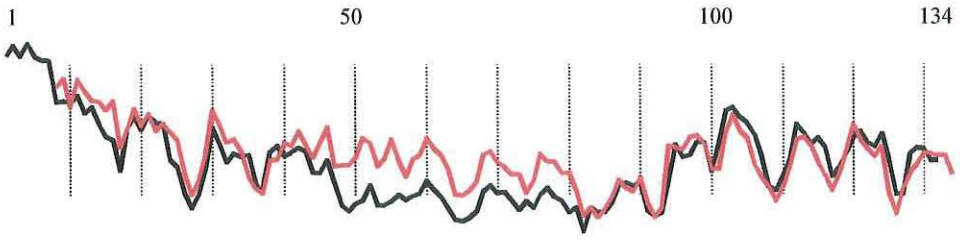


Figure 7 Plan of the tower roof base frame, (after Atkins and Rodwell pers comm), showing approximate location of samples from this area. Sample 23 is from a rafter above this frame, the timber sampled as 24 and its opposite partner (marked +) appear to be re-used timbers from an earlier bellframe, the timber they are jointed to in the middle of the frame (marked *) is pine. Note that the bellframe (unfortunately a relatively modern metal one) and the bells severely restricted safe access to this structure

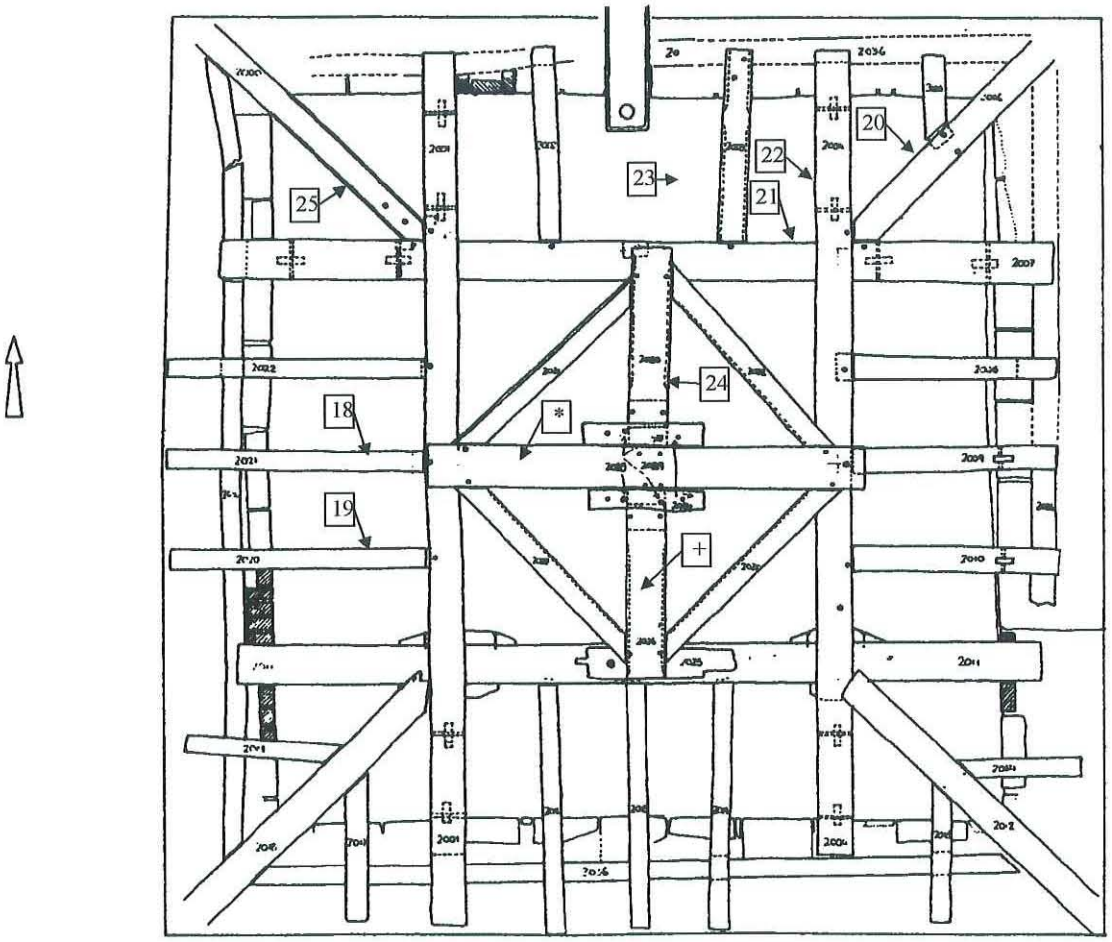


Figure 8 Plan of the roof beams, showing approximate locations of the roof and corbel samples (after Caroline Atkins pers comm)

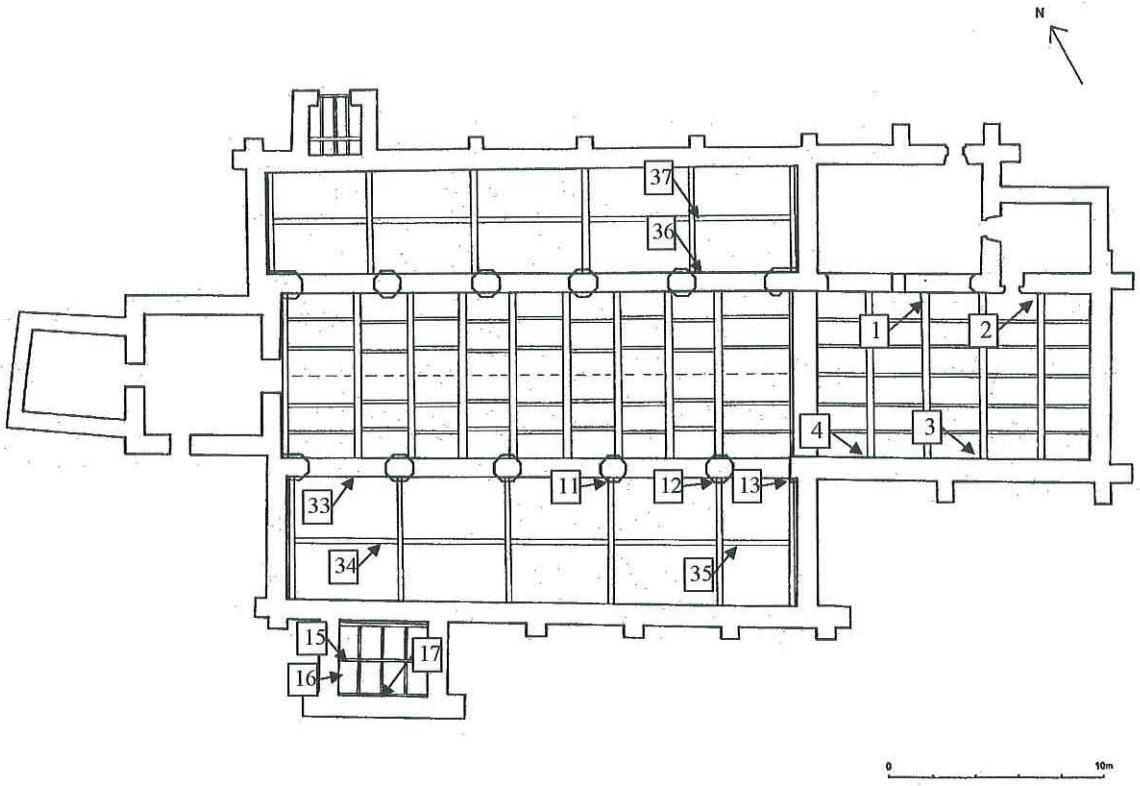


Figure 9 Photograph of inner face of north door showing the horizontal planks. The sequences were recovered from the cut face at the inner hinged end of the later wicket gate.

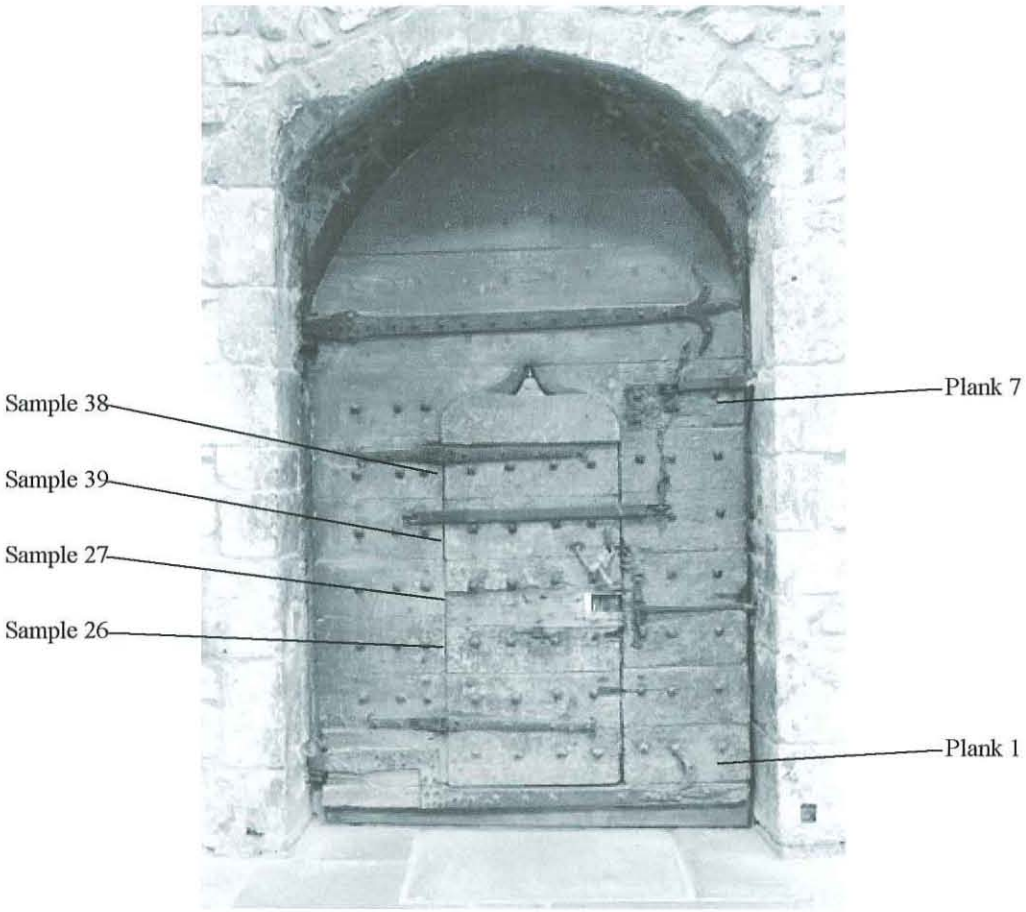


Figure 10 Sketch of the chancel screen looking east, with the doors ajar in the centre, showing the numbering scheme adopted for the decorated panels and the location of the photographic mosaics and *FIMO* mould samples.

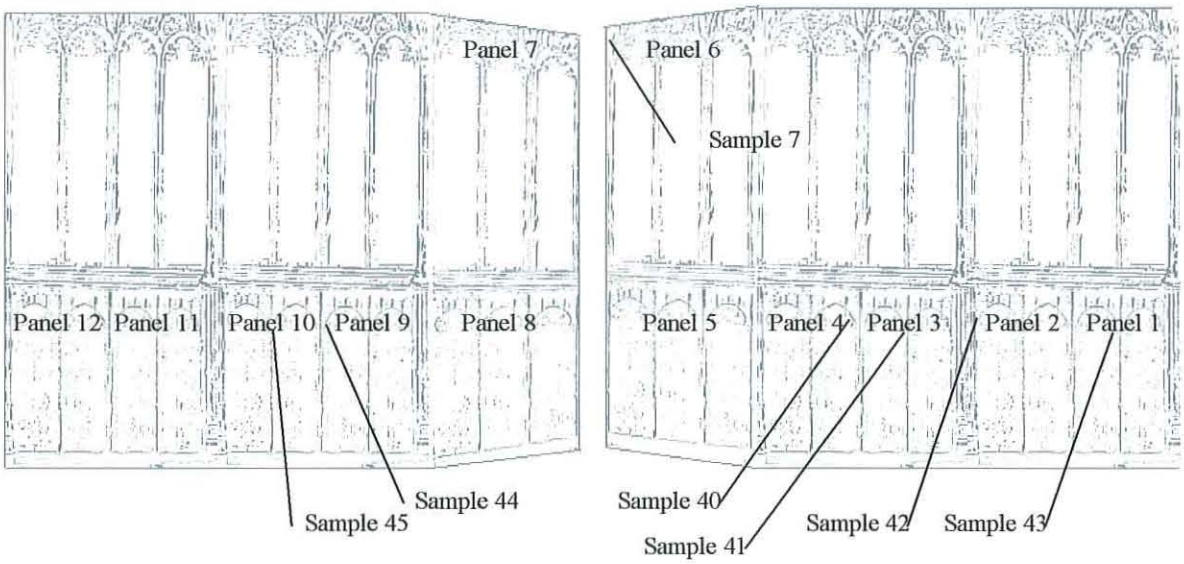
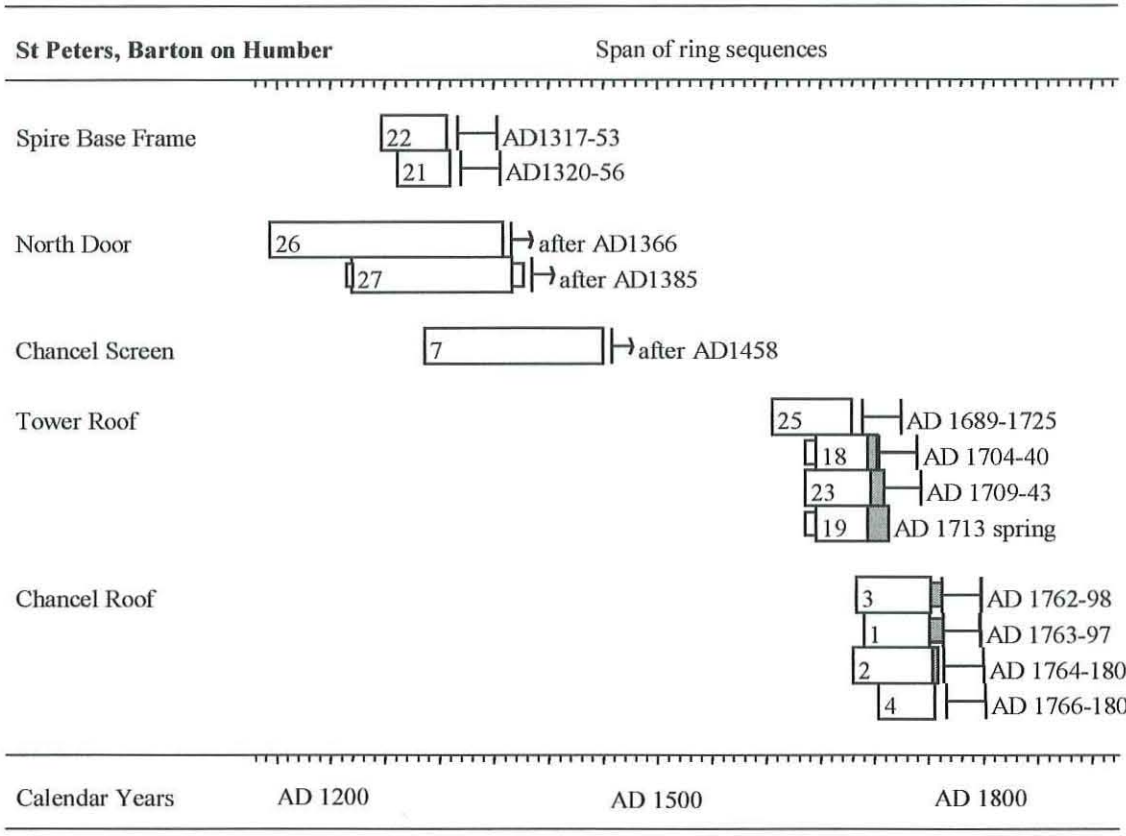


Figure 11 Bar diagram showing the chronological positions of the dated timbers from the church of St Peter, Barton on Humber. The felling period for each sequence is also shown



KEY

Table 1

List of samples obtained from the church of St Peter, Barton on Humber

No	Origin of sample	Total rings	Sapwood rings	ARW mm/year	Date of sequence	Felling period
	TOWER AND BAPTISTRY					
5	Tower north wall lower plate	41	h/s	2.29	Undated	-
6	Tower north wall upper plate	52	h/s?	1.65	Undated	-
8	Baptistry north wall joist 1	32	h/s	2.64	Undated	-
9	Baptistry north wall joist 2	54	h/s	2.69	Undated	-
10	Baptistry north wall joist 3	39	-	2.69	Undated	-
14	Tower south wall lower plate	-	-	-	Not measured	-
	RINGING FLOOR					
28	Beam 2345?	132	-	1.14	Undated	matches **29**
29	Beam 2346	127	-	1.07	Undated	matches **28**
30	Large beam 1	40	-	2.70	Undated	-
31	Large beam 2	36	-	2.95	Undated	-
32	Pine beam	-	-	-	Not measured	-
	TOWER BASE FRAME					
21	North east-west tiebeam	49	h/s	2.89	AD1262-AD1310	AD1320-56
22	East north-south tiebeam	61	h/s	2.23	AD1247-AD1307	AD1317-53
	NORTH AISLE					
36	South wall plate, eastern bay	-	-	-	Not measured	-
37	Central roof beam, eastern bay	-	-	-	Not measured	-
	NORTH DOOR					
26	Inner layer horizontal plank 3 *	215	-	0.85	AD1144-AD1358	after AD 1366
27	Inner layer horizontal plank 4 *	148+*10*	-	1.15	AD1220-AD1367	after AD 1385
38	Inner layer horizontal plank 6 *	110	-	0.91	Undated	-
39	Inner layer horizontal plank 5 *	150	-	0.99	Undated	-
	SOUTH AISLE					
11	North wall corbel 3	-	-	-	Not measured	-
12	North wall corbel 2	53	h/s	1.56	Undated	-
13	North wall corbel 1	74	h/s	0.90	Undated	-
33	North wall plate, western bay	116	h/s	1.09	Undated	-
34	Central roof beam, western bay	-	-	-	Not measured	-
35	Central roof beam, eastern bay	85	-	1.57	Undated	-

Table 1 (cont)

No	Origin of sample	Total rings	Sapwood rings	ARW mm/year	Date of sequence	Felling period
	SOUTH PORCH					
15	Central tiebeam	90	13	2.00	Undated	
16	West rafter, 2 south of centre	48	6	2.52	Undated	
17	South wall plate	67	-	2.40	Undated	
	CHANCEL SCREEN					
7	South door upper panel 6 **	164	-	1.68	AD1287-AD1450	after AD1458
40	South screen panel 4 **	-	-	-	Not measured	-
41	South screen panel 3 **	-	-	-	Not measured	-
42	South screen panel 2 **	-	-	-	Not measured	-
43	South screen panel 1 **	-	-	-	Not measured	-
44	North screen panel 9 **	-	-	-	Not measured	-
45	North screen panel 10 **	-	-	-	Not measured	-
	TOWER ROOF					
18	West side horizontal, lower frame	58	9	2.18	AD1646-AD1703	AD1704-40
19	West side horizontal, lower frame	68	19+Bs	2.00	AD1646-AD1713	AD1713 spring
20	North-east dragon beam	98	h/s	1.27	Undated	-
23	North side rafter, upper frame	74	12	1.69	AD1636-AD1709	AD1709-43
24	Central cruciform, north beam	75	h/s	1.54	Undated	-
25	North-west dragon beam	74	h/s	2.15	AD1606-AD1679	AD1689-1725
	CHANCEL ROOF					
1	Tiebeam 2	62	*+12s*	2.44	AD1690-AD1751	AD1763-97
2	Tiebeam 4	80	5	2.03	AD1680-AD1759	AD1764-1800
3	Tiebeam 3	70	h/s *+10s*	2.04	AD1683-AD1752	AD1762-98
4	Tiebeam 1	53	h/s	2.76	AD1704-AD1756	AD1766-1802
	PINE CHEST					
48	Lid board back	-	-	-	Not measured	-
49	Lid board front	-	-	-	Not measured	-
	DUGOUT CHEST					
47	Base inner right face	-	-	-	Not measured	-
	CORBEL HEAD					
46	Reverse	-	-	-	Not measured	-

Table 1 KEY

Unless otherwise stated numbering series assigned to beams, etc, are counted from the chancel arch end

Samples are oak except **32**, **48**, and **49** which are pine

Total rings = all measured rings, numbers in *italics* indicate unmeasured heartwood rings
Sapwood rings: h/s heartwood/sapwood boundary, ?b possible bark edge, Bs bark spring felled, numbers in *italics* indicates unmeasured heartwood rings, numbers in italics with *s* appended indicates unmeasured sapwood rings
ARW = average ring width of the measured rings

* The north door planks were numbered from the bottommost, the later wicket gate cuts the lowest seven horizontals of the twelve planks that form this layer see Fig 9 for details

** The decorated panels were numbered from south to north, ignoring the upper panels of the static elements of the screen, but including the upper panels of the doors see Fig 10 for details

Table 2

t-value matrix for the samples from the tower roof forming the interim chronology BOHSP_TR. KEY: - = *t*-values under 3.0

Samples	19	23	25
18	11.20	4.52	-
19		5.13	-
23			4.01

Table 3

t-value matrix for the samples from the chancel roof forming the interim chronology BOHSP_CR

Samples	2	3	4
1	6.30	5.49	3.00
2		6.38	5.40
3			5.77

Table 4

Dating the mean BOHSP_BF. *t*-values with independent reference chronologies

Reference Chronology	**BOHSP_BF** AD 1247 - AD 1310
East Midlands regional master (Laxton and Litton 1988)	5.41
Essex, Tiptofts nr Wimbish (Tyers 1999d)	4.27
Nottinghamshire, Bilby bridge nr Retford (Morgan pers comm)	6.69
Derbyshire, Chesterfield Builders Wheel (Groves and Tyers 1993)	5.35
Staffordshire, Burton Abbey Green (Howard *et al* 1998a)	4.09
Reading Abbey waterfront (Groves *et al* 1997)	4.41
Gloucestershire, Old Hat Shop Tewkesbury (Nayling 2000)	4.55
Gloucestershire, Twyning Bellframe (Tyers 1996)	4.82
W Yorkshire, Nostell Priory (Tyers 1998b)	5.91
N Yorkshire, York 60 Stonegate (author unpubl)	4.16
N Yorkshire, York Bedern Hall (Hillam 1982)	4.28

Table 5

Ring-width data from the base frame chronology BOHSP_BF dated AD 1247-1310 inclusive.

Date	**Ring widths (0.01mm)**										**No of samples**									
AD 1247							408	247	173	237							1	1	1	1
AD 1251	191	142	174	186	264	299	273	163	176	249	1	1	1	1	1	1	1	1	1	1
	263	376	436	404	263	311	280	367	409	374	1	2	2	2	2	2	2	2	2	2
	320	223	256	173	213	280	348	291	264	352	2	2	2	2	2	2	2	2	2	2
	368	284	251	301	324	278	140	153	275	298	2	2	2	2	2	2	2	2	2	2
	318	335	350	283	228	197	187	147	100	109	2	2	2	2	2	2	2	2	2	2
AD 1301	145	170	175	143	156	167	135	106	116	117	2	2	2	2	2	2	2	1	1	1

Table 6

Dating the three Baltic plank series mean from the north door and chancel screen. *t*-values with independent reference chronologies. KEY: - = *t*-values under 3.0

Reference Chronology	26	27	7
Lincolnshire NE, Grimsby boat planks (Groves 1992)	5.82	4.06	-
London Millennium Bridge boards (Tyers 1999e)	6.47	4.78	-
London Abbots Lane door planks (Tyers 1994)	6.31	6.00	-
Poland, Copper Wreck boat Bonde/Wazny unpubl data	8.24	4.71	3.20
Poland, Copper Wreck cargo Bonde/Wazny unpubl data	4.19	5.84	3.92
Tudor portrait panels area 2 chronology (Hillam and Tyers 1995)	3.55	3.98	6.21
Yorkshire East, Hull Chapel Lane boat planks (Tyers 2000)	6.89	5.00	3.56
Yorkshire East, Hull coffin boards (Tyers 1998a)	7.12	3.78	3.81
Yorkshire North York Zouche Chapel (Fletcher and Morgan 1981)	3.15	5.54	-
Yorkshire North, Coppergate boat (Groves and Hillam forthcoming)	5.35	5.59	3.05

Table 7

Ring-width data from the north door sample **26** dated AD 1144-1358 inclusive.

Date	Ring widths (0.01mm)									
AD 1144				91	64	92	88	102	109	104
AD 1151	67	92	122	102	85	106	78	94	114	132
	99	86	86	85	65	80	84	99	54	86
	81	97	95	106	68	69	75	89	82	84
	87	113	108	60	67	103	103	124	81	74
	92	69	64	82	110	129	119	96	121	96
AD 1201	85	58	74	109	85	114	76	82	64	67
	81	64	64	76	79	55	69	62	58	50
	54	45	39	75	67	59	51	51	81	73
	65	79	74	79	69	63	85	86	101	58
	58	69	106	72	74	70	89	70	103	80
AD 1251	119	100	94	103	163	76	109	94	137	75
	67	60	81	70	64	97	112	108	117	84
	104	64	67	89	90	111	79	46	74	90
	95	82	60	69	88	93	70	71	75	91
	95	69	83	82	77	105	100	101	115	86
AD 1301	106	112	76	62	56	65	78	85	71	72
	88	124	142	98	112	87	83	119	72	106
	109	91	72	82	82	70	92	93	88	79
	80	84	72	111	67	92	100	79	116	101
	95	83	95	82	89	72	73	66	68	76
AD 1351	84	63	79	78	59	72	71	72		

Table 8

Ring-width data from the north door sample **27** dated AD 1220-1367 inclusive.

Date	Ring widths (0.01mm)									
AD 1220										119
	108	115	100	102	92	143	163	155	130	162
	135	120	153	135	115	91	122	139	119	108
	84	94	122	83	82	83	109	107	113	119
AD 1251	115	134	142	130	140	139	115	80	128	83
	85	100	102	105	107	129	123	130	145	127
	153	152	148	142	136	126	162	120	106	133
	136	122	138	123	140	135	113	127	108	108
	114	104	106	125	123	152	111	122	125	125
AD 1301	135	143	111	111	91	103	89	87	113	116
	115	123	121	115	121	127	101	107	117	128
	113	127	105	99	100	92	116	125	113	124
	124	108	88	91	90	112	116	110	123	94
	92	90	99	77	94	102	103	118	89	89
AD 1351	102	93	100	85	82	95	88	117	121	113
	105	112	115	116	129	128	111			

Table 9

Ring-width data from the chancel screen sample **7** dated AD 1287-1450 inclusive.

Date	Ring widths (0.01mm)									
AD 1287							326	257	276	273
	305	266	289	369	325	307	324	327	273	321
AD 1301	194	271	198	120	200	164	282	198	176	159
	122	165	245	249	209	206	147	154	198	187
	206	180	186	155	195	136	228	203	142	192
	183	153	115	157	225	230	234	290	228	189
	178	197	153	134	132	116	73	84	95	106
AD 1351	111	136	139	151	193	123	87	78	109	145
	139	134	143	158	171	153	156	138	143	140
	160	140	176	156	159	135	151	192	162	192
	229	167	167	119	141	172	161	146	129	129
	119	172	146	99	112	184	113	150	148	144
AD 1401	113	177	118	124	117	196	154	174	129	183
	151	163	161	155	144	169	122	116	116	97
	105	102	82	91	120	99	95	126	158	158
	140	138	135	147	171	150	175	141	106	156
	128	149	216	146	180	185	128	110	161	164

Table 10

Dating the mean BOHSP_TR. *t*-values with independent reference chronologies

Reference Chronology	**BOHSP_TR** AD 1606 - AD 1713
East Midlands regional master (Laxton and Litton 1988)	8.68
Bedfordshire, Chicksands Priory (Howard *et al* 1998b)	4.40
Essex, Cressing Temple Barley Barn (Tyers 1992)	5.34
Lincolnshire, Bay Hall Benington (Howard *et al* 1999a)	5.07
Derbyshire, Bretby Hall Bretby (Howard *et al* 1999b)	5.85
Lincolnshire, Lincoln Vicars Court (Hillam and Groves 1996)	5.52
Staffordshire, Sinai Park (Tyers 1997a)	5.63
Buckinghamshire, Claydon House Middle Claydon (Tyers 1995)	4.93
Welsh Border (Siebenlist-Kerner 1978)	4.45

Table 11

Ring-width data from the tower roof chronology BOHSP_TR dated AD 1606-1713 inclusive

Date	**Ring widths (0.01mm)**										**No of samples**									
AD 1606						355	305	406	414	398						1	1	1	1	1
	385	483	376	272	243	302	295	291	307	258	1	1	1	1	1	1	1	1	1	1
	320	395	441	410	275	268	287	301	352	241	1	1	1	1	1	1	1	1	1	1
	266	330	279	159	148	167	151	215	234	195	1	1	1	1	1	2	2	2	2	2
	244	207	158	159	167	128	102	105	71	57	2	2	2	2	2	4	4	4	4	4
AD 1651	85	76	136	184	281	273	170	184	144	201	4	4	4	4	4	4	4	4	4	4
	161	185	180	152	136	180	180	205	236	234	4	4	4	4	4	4	4	4	4	4
	237	236	195	198	151	177	215	222	203	246	4	4	4	4	4	4	4	4	4	3
	242	343	202	154	165	268	196	171	138	182	3	3	3	3	3	3	3	3	3	3
	216	189	229	164	186	250	275	249	235	186	3	3	3	3	3	3	3	3	3	3
AD 1701	242	167	194	191	134	152	152	161	156	121	3	3	3	2	2	2	2	2	2	1
	152	159	120								1	1	1							

Table 12

Dating the mean BOHSP_CR. *t*-values with independent reference chronologies.

Reference Chronology	**BOHSP_CR** AD 1680 - AD 1759
East Midlands regional master (Laxton and Litton 1988)	7.65
Essex, Thaxted Church (Tyers 1990)	5.26
Essex , Tilbury Fort (Groves 1993)	4.88
London, Charringtons Wharf Blackwall (Tyers 1999f)	5.53
Derbyshire, Bretby Hall Bretby (Howard *et al* 1999b)	4.83
Staffordshire, Sinai Park (Tyers 1997a)	5.41
Buckinghamshire, Claydon House Middle Claydon (Tyers 1995)	4.30
Reading Abbey waterfront (Groves *et al* 1997)	4.54
Surrey, Wanborough Barn (Tyers 1997b)	4.97
Hampshire, Great Barn Old Basing (Bridge 1996)	5.19
W Yorkshire, Nostell Priory (Tyers 1998b)	6.06

Table 13

Ring-width data from the chancel roof chronology BOHSP_CR dated AD 1680-1759 inclusive.

Date	**Ring widths (0.01mm)**										**No of samples**									
AD 1680										237										1
	191	234	229	119	95	124	166	189	255	162	1	1	2	2	2	2	2	2	2	3
	219	135	186	219	170	135	161	185	206	227	3	3	3	3	3	3	3	3	3	3
AD 1701	269	224	246	312	191	175	209	283	233	136	3	3	3	4	4	4	4	4	4	4
	165	184	188	211	283	251	231	210	193	186	4	4	4	4	4	4	4	4	4	4
	303	318	221	279	207	287	280	273	336	320	4	4	4	4	4	4	4	4	4	4
	283	295	270	285	330	218	169	269	380	223	4	4	4	4	4	4	4	4	4	4
	204	173	204	204	221	226	203	197	197	178	4	4	4	4	4	4	4	4	4	4
AD 1751	216	207	233	242	245	283	266	184	213		4	3	2	2	2	2	1	1	1	

Appendix 1 Photographs of core holes at St Peter's church, Barton on Humber, prior to filling with oak plugs. These snapshots were taken as a requirement of the Scheduled Monument Consent for the dendrochronological sampling programme. Note that difficulties of access has resulted in some poorly focussed results. Cores 1-2.

Core 1

Core 2

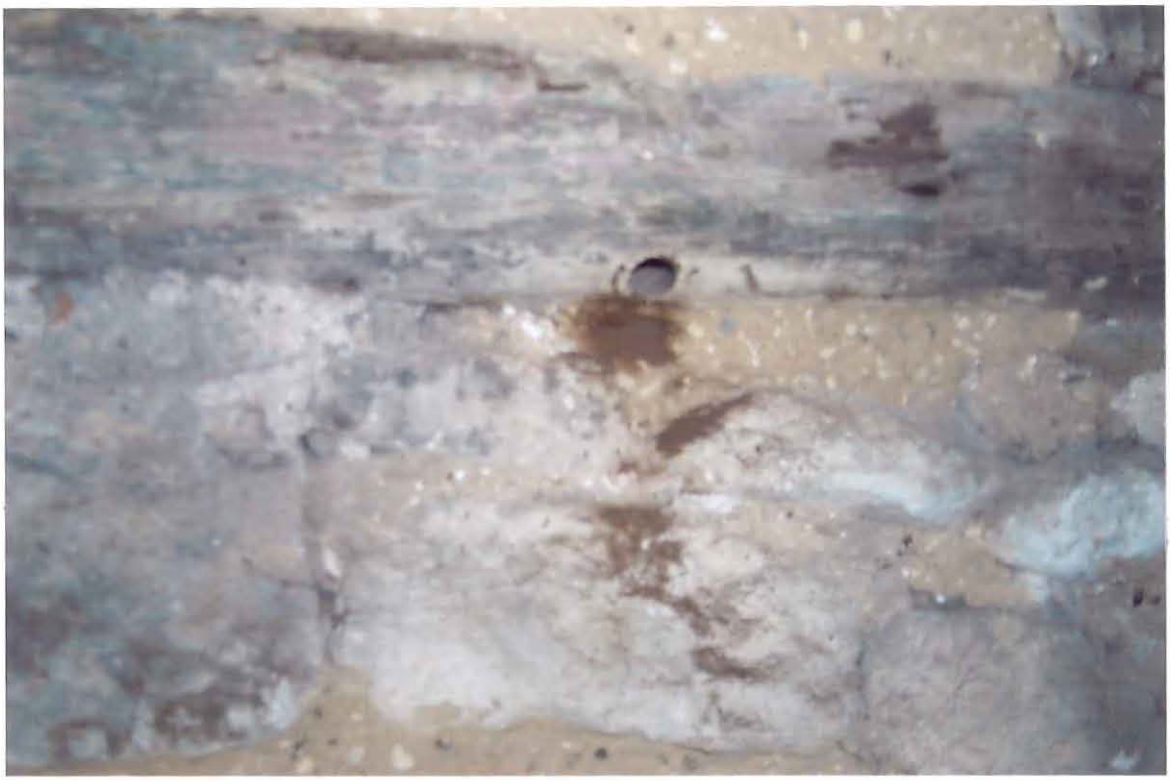
Appendix 1 continued Photographs of core holes. Cores 3-4

Core 3

Core 4

Appendix 1 continued Photographs of core holes. Core 5

Core 5



Core 5 repeat

Appendix 1 continued Photographs of core holes. Core 6

Core 6

Core 6 repeat

Appendix 1 continued Photographs of core holes. Cores 6 and 8

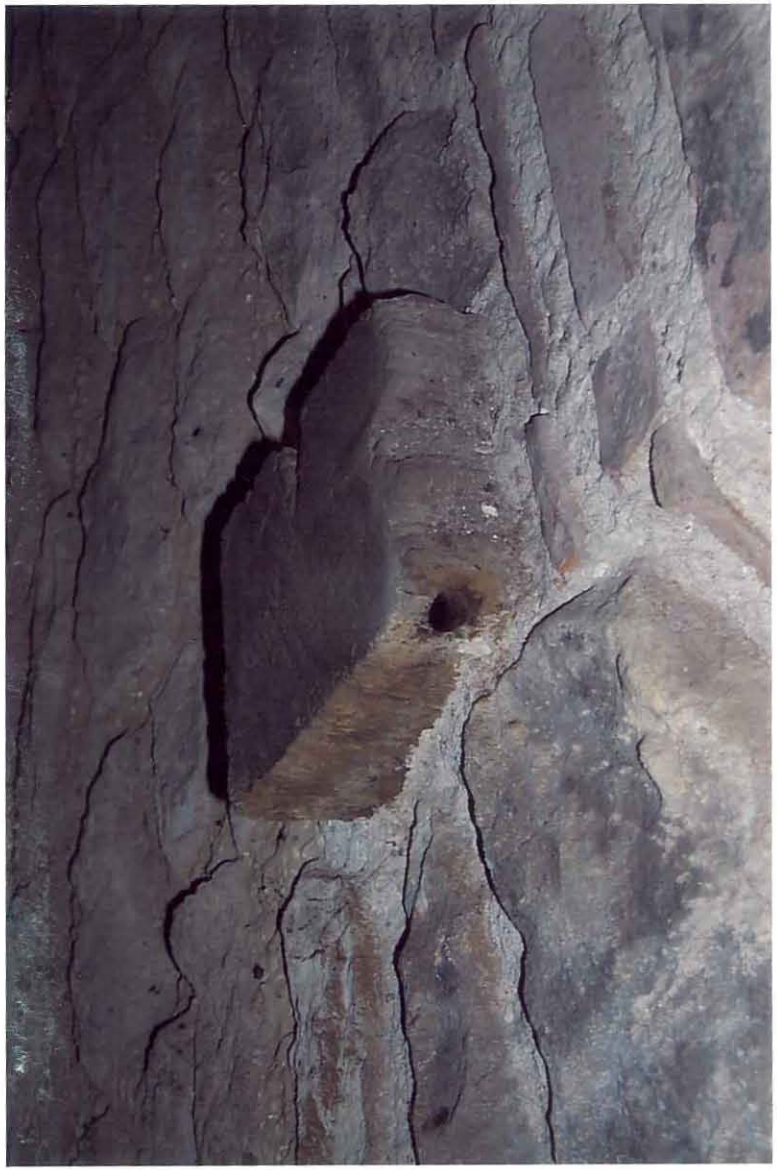
Core 6 repeat 2

Core 8

Appendix 1 continued Photographs of core holes. Cores 9-10

Core 9

Core 10



Appendix 1 continued Photographs of core holes. Cores 11-12

Core 11

Core 12

Appendix 1 continued Photographs of core holes. Cores 13-14

Core 13

Core 14

Appendix 1 continued Photographs of core holes. Cores 15-16

Core 15

Core 16

Appendix 1 continued Photographs of core holes. Cores 17-18

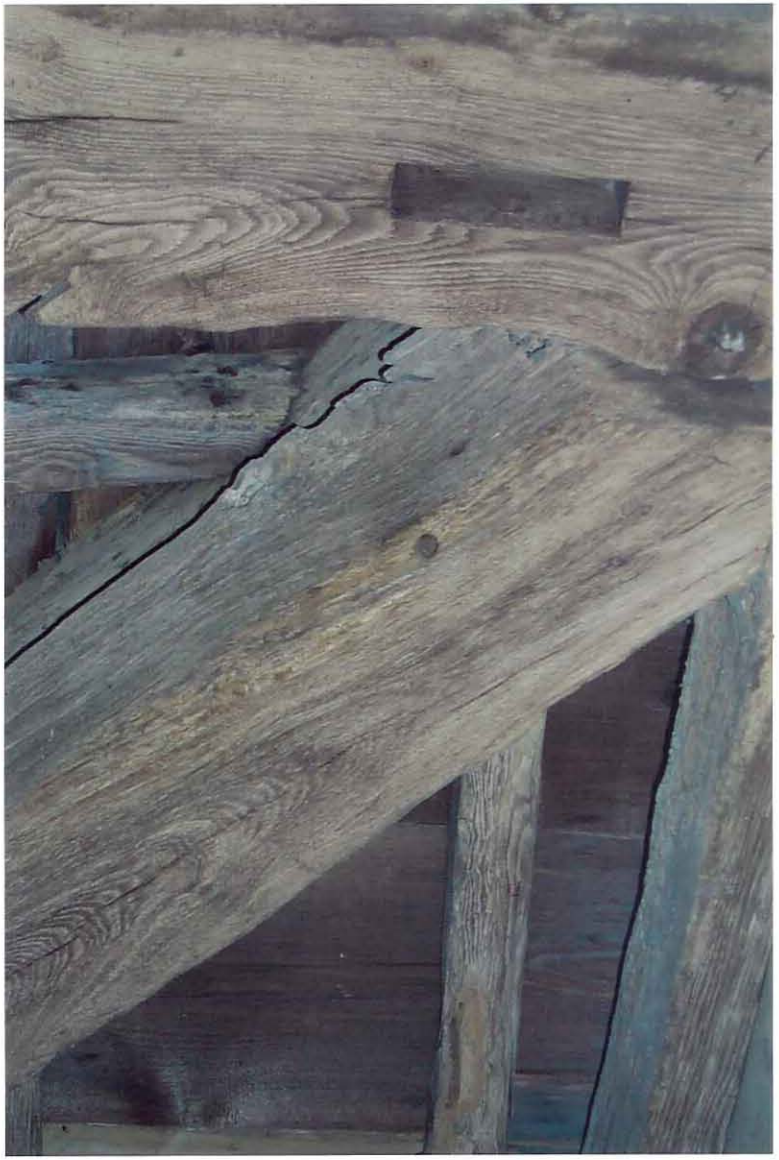
Core 17

Core 18

Appendix 1 continued Photographs of core holes. Cores 19-20

Core 19

Core 20



Appendix 1 continued Photographs of core holes. Cores 21-22

Core 21

Core 22

Appendix 1 continued Photographs of core holes. Cores 23-24

Core 23

Core 24

Appendix 1 continued Photographs of core holes. Cores 25 and 33

Core 25

Core 33

Appendix 1 continued Photographs of core holes. Cores 34-35

Core 34

Core 35